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Solution-Processed hybrid Sb2S3 planar heterojunction solar cell

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— Thin-film solar cells based on inorganic absorbers permit a high efficiency and stability. Among or those absorber candidates, recently Sb2S3 has attracted extensive attention because of its suitable band gap (1.5eV ˜1.7 eV) , strong optical absorption, low-cost and earth-abundant constituents. Currently high-efficiency Sb2S3 solar cells have absorber layer deposited on nanostructured TiO2 electrodes in combination with organic hole transport material (HTM) on top. However it's challenging to fill the nanostructured TiO2 layer with Sb2S3 and subsequently by HTM, this leads to uncovered surface permits charge recombination. And the existing of Sb2S3/TiO2/HTM triple interface will enhance the recombination due to the surface trap state. Therefore, a planar junction cell would not only have simpler structure with less steps to fabricate but also ideally also have a higher open circuit voltage because of less interface carrier recombination. By far there is limited research focusing on planar Sb2S3 solar cell, so the feasibility is still unclear. Here, we developed a low-toxic solution method to fabricate Sb2S3 thin film solar cell, then we studied the morphology of the Sb2S3 layer and its impact to the device performance. The best device with a structure of FTO/TiO2/Sb2S3/P3HT/Ag has PCE over 5% which is similar or higher than yet the best nanostructure devices with the same HTM. Furthermore, based on solution engineering and surface modification, we improved the Sb2S3 film quality and achieved a record PCE. .

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